SOME REMARKS

ON THE

ADVANTAGES

OF

PROSSER'S PATENT RAILWAY GUIDE WHEELS

ON EITHER

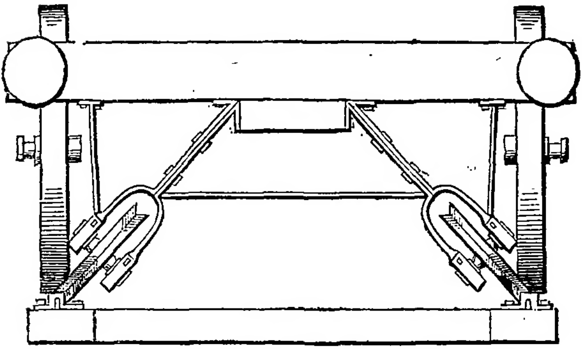
IRON OR WOODEN RAILS.

LONDON:

J. KING, PRINTER, COLLEGE HILL, CITY.

1845.

PROSSER'S PATENT RAILWAY GUIDE WHEELS.



FRONT ELEVATION.

Many improvements have been made in the construction of Railways since their first introduction, and experience daily suggests some mode of overcoming difficulties and impediments that still exist. The chief attention of engineers has been to improve the mode of locomotion, and accelerate the speed of trains of carriages; very little attention was paid to the advantages of improving the mode of guiding carriages along the rails, and diminishing the friction and wear and tear of machinery, until Mr. Prosser's patent for guide wheels came out. The first idea of the Patentee was certainly to invent such a mode of guiding carriages along the rails as should enable him to construct cheap lines, by the substitution of a cheaper material for rails than iron; but the advantages derived from the substitution of a guide wheel for the flange on the bearing wheels is equally applicable to iron rails as to any other material. The invention being simple, a short description of the guide wheel will suffice to give the public some idea of their construction.

The four principal wheels which support the carriage are without flanges, and present a perfectly flat surface to the rail. It is evident that, upon encountering the slightest curve in the rails, these wheels would be quite inadequate to keep the carriage upon its destined route; the remedy provided is in four extra or anti-friction wheels; these are placed, two in front and two behind the carriage, upon axles, at an angle of 45 degrees: a deep groove formed by two flanges is made in their circumference, exactly corresponding to the inner and upper angle of the rail, and thus they serve as the guiding wheels to the whole machine.

When the Railway is in the direction of a right line, only one of each pair of bevel wheels can be in action at the same time, according to the tendency which the carriage may have to move on either side from the centre of the rail. On a curve, the difference is simply that the outside bevel wheel of the front pair, and the inside one of the back pair, come into play, and counteract the dis-

position there is in the carriage to fly off at a tangent with the curve.

Another very important function performed by the bevel wheels is, that in case of an accident occuring to the running wheels, they would act as supporters to the carriage, and carry it on in safety.

The truth of this assertion was clearly demonstrated by experiments made in the presence of a number of scientific gentlemen, on the trial line at Vauxhall. When the fore-wheels of the steam carriage were removed, it ran without them at full speed, throwing the whole weight of the front portion of the carriage and its passengers on the bevel or guide wheels.

The length of the experimental line laid down near Vauxhall-bridge was 174 yards, with gradients of 1 in 95, 1 in 22, and 1 in 9, and a curve of 720 feet radius.

The speed attainable on so short a line was of course limited, but the power given to the engineer by the bite of the wheel on the wood (for this line was laid with wooden rails) enabled him to drive it at the rate of 24 miles an hour, and to stop the carriage in a distance of 24 yards. In the presence of several engineers, the carriage laden with passengers ascended an incline of 1 in 9, the rails being in a very bad state at the time from wet.

The curve was near the centre of the line, where the carriage necessarily passed over it when going at its greatest speed, thus testing the safety of the bevel wheels.

A curve of 600 feet radius may be traversed with safety at a speed of 25 to 30 miles per hour by means of the bevel wheels; and a model of a locomotive engine and train, constructed to a scale of $1\frac{1}{2}$ inch to the foot, travelled round a curve of 9 feet radius, at a speed equally to 40 miles per hour, and traversed over upwards of 50,000 miles without the slightest accident.

By the adoption of these guide wheels the annual expense of working a line will be materially diminished, the wear and tear of engines and carriages, resulting from the continual abrasion and oscillation, which is caused by the flange wheel is obviated. In using the flange wheel, a great loss of power is also sustained consequent on the continual friction produced by the flanges against the edge of the rail; an experiment to test the difference in power required to propel a carriage fitted with the guide wheels, and one with the usual flange wheel, was made last autumn, on the Hayle Railway in Cornwall. A loaded truck fitted with the guide wheels, and divested of the flanges on the bearing wheels was found to be propelled with *one fourth* less power than a similar truck equally laden, but with the usual flange wheel, thus clearly demonstrating the advantages of the guide wheel in saving of power. The only obstruction to running carriages with the guide wheel upon the Railways already constructed, are the form of the chairs, which, coming within $1\frac{1}{2}$ inch of the top of the rail, do not give sufficient depth for the groove of the guide wheel; in Railways about to be made, the substitution of a chair with the inner cheek lower will enable the managers to run their trains with either the guide wheels or the flange, so that it would not prevent trains from other Rail-

ways unprovided with the guide wheels from travelling over their line, although they for economy may themselves adopt the guide wheel.

In traversing curves the advantage is still more apparent. In the present arrangement the flanches of the wheels grind with great force against the edge of the outer rail, and produce an increased strain on the axles and other portions of the carriage, and each concussion acts with more or less injury on the machinery of the engine, the flange wheels being of necessity connected with it; here, by the substitution of the bevel wheels, the line of direction is altered with greater ease, and without affecting the driving or running wheels of the engines or carriages.

Another great advantage by the adoption of the patent guide wheel, is their enabling carriages to travel over a line of Railway with rails of less cost than iron, such as wood, also to reduce the expences of making the line.

The cost which hitherto has attended the formation of Railroads, averages £25,000 per mile, being 2,600 miles at a cost of 63½ millions. A few of these (where the traffic is great) work at a profit; there are others that pay common interest; while there are some that make no return whatever to the Shareholders. Under these circumstances it is obvious that branch or shorter lines of Railways cannot be laid down on the present system without, in many instances, a great sacrifice of capital. It follows therefore that the introduction of an economical plan would enable all provincial towns to have an expeditious means of access to the metropolis, or to the existing lines of Railway, and thus place them on an equality with other rival districts.

Since the introduction of wood paving, it may be calculated that a saving of one-half has been effected in the wear and tear of carriages, horses, and harness, in those districts where it has been adopted; a saving equally great can be made in the construction of Railroads by the substitution of wood for iron rails.

The rails may be made of beech, or other hard English timber, six to eight inches square, let into wooden sleepers, and secured by wooden wedges, forming one great frame or wooden grating of longitudinal and cross sleepers.

The bite of the wheel upon an iron rail depends much on the weight of the engine. It is generally made to weigh from 16 to 18 tons, which, on moderate gradients, and at a speed of 20 or 30 miles per hour, enables it to draw from 80 to 100 tons. The carriages are built to weigh about three tons; this strength is found necessary to withstand the concussion, abrasion, and oscillation.

An engine weighing 10 tons, running on wood, will have more tractive power than one weighing 18 tons running on iron; and as the concussion and abrasion on wood is so trifling, carriages built to weigh one and a half tons will be as strong as those having to run on iron weighing three tons.

An important question connected with this subject is the durability of the material of which the rails are composed.

The engine employed for the experiment weighed about six tons: it passed over the rails during the two months it ran 8,000 times, in every variety of weather, which is equal to nearly seven years' traffic of 12 engines per day. The rails consisted of Scotch fir, about nine feet long and six inches square; and yet, upon examining them after the severe test to which they had been subjected, they exhibited no appearance of wear from the friction of the wheels on the upper surface, as the saw marks were not even effaced, nor had the bevel wheels exercised any abrasing effect on the edges, which remained as sharp and well defined as they were when first laid down.

The capability of wood to sustain the strain to which it must necessarily be exposed, especially when moving over it at high velocities, has been satisfactorily proved by the experience of the Great Western and other Railways, where continuous longitudinal sleepers of wood have been employed, and experience has shewn that the solidity of the road is much greater than when the iron rails were attached either to stone blocks, or transverse wooden sleepers. In proof that wooden rails cut from beech will bear the wear and tear of trains passing over it, it is well known that beech cogs have been known to last 18 to 20 years, when working in gear with an iron wheel.

The rails on the Vauxhall line were prepared by Payne's patented process for preventing dry-rot and decay of timber.

Scotch fir, if subjected to pressure, will crush at 10 tons, while beech, (the wood recommended for Railways,) will bear a pressure of 82 tons before it begins to yield.

Experience having confirmed the capability of Scotch fir to withstand the traffic of 12 engines per day for seven years, without any visible wear,—it would be difficult to say how long rails cut from beech, sustaining 82 tons pressure, would last.

It will be quite needless to dwell longer on this subject, when it is stated that the cost of renewing the beech rails, including the preservation of them from dry-rot, will not exceed £400 per mile for a single line of road.

Some of the impediments with which Railroads have to contend, are, the undulations of the country, and the necessity of diverging from a right line, in order to obtain the traffic of important towns.

These obstacles can only be overcome by an enormous outlay of capital, in making the required excavations and embankments, or by the oftentimes ruinous system of tunnelling,—and, after all, inclines of greater or less gradients are unavoidable, and prevent the line being worked economically. Curves on iron Railroads are highly prejudicial, especially if the radius be small, as the wear and tear becomes proportionably increased.

Now, by the introduction of the proposed plan, the evils arising from the obstacles alluded to would be very materially diminished; for, in the first place, the surface resistance obtained by the elastic character of wooden rails, enables a train to be propelled up inclines, with much greater facility and ease than on rails constructed

of iron; and the peculiar construction and arrangement of these patent guide wheels give a train the power to traverse curves with comparative ease, which would not be attempted on the present system.

The cost of making Railroads depends much on the quantity of ground to be removed; it is obvious, that if embankments can *to any extent* be avoided, a great saving would be effected,—the subsequent expense of the keeping them in repair reduced, delays in the traffic from slips, and from sinking of sleepers avoided, and the danger to passengers lessened, as from the latter cause many lives have been sacrificed.

The advantages of wooden Railways thus constructed, in point of economy, comfort, durability, and as feeders to the great and central lines already formed, must be apparent to every one who has given the subject any consideration.

Thus long lines of Railway may be laid down with iron rails, whilst the feeders from different towns within their reach may be accommodated with Railway communication at expense that their more limited traffic will warrant the Proprietors to incur.

These branch Railways will pour into the main lines a great accession of traffic, and yield to the enterprising promoters of them a large and certain profit on the money expended in their formation; it is therefore to the interest of Railway Proprietors to be among the great supporters of this plan.

On Railways thus constructed the fares will not exceed, if properly managed, for first class passengers, *two-pence*, and for second class, *one penny* per mile. These prices ought to insure ample profit to the Shareholders, and give Directors the pleasing duty of providing for the accommodation of the *poorer class* of *Railway travellers*, carriages that will shelter them from the inclemency of all weathers: such protection is of paramount importance to a class of society who depend on the vigour of their constitution and their health for subsistence.

The result of a series of experiments, made to ascertain the proportionate power of the bite of wood over iron, has fully borne out the assertion of the Patentee, that the bite of the driving wheel on wood is nearly double that on iron.

On the surface of an iron wheel four feet diameter, a lever eight feet long was placed, with a weight of seven lbs. attached to the lever three feet from the centre of the axis of the wheel; the surface of the lever being iron at the tangent of the wheel, it required a weight of 28lbs. attached to the crank to make it revolve. On substituting a wood surface for the iron one, it required a weight of 42lbs.

Another experiment confirmed the result with the iron surface; a weight of 28lbs attached to the spoke of the wheel, at a distance of six and three quarter inches from the centre, made it revolve; whilst, with a wood surface, it required the same weight to be attached to the spoke at a distance of $11\frac{1}{2}$ inches from its centre, thus clearly demonstrating the power obtained by the bite of the wood is nearly double the bite of iron.

The Proprietors of the patent have just completed a line of Railway near two miles in length on Wimbledon Common, expressly to shew the advantages their guide wheels possess over the flange; and in this short line, part of which is laid with wooden and part with iron rails, they have all the difficulties they profess to overcome, viz. various gradients, say 1 in 50, 1 in 75, and 1 in 100, a circle, the radius of which is 10 chains; and they are running a train of carriages which will continue the next six months: thus practically testing the durability and efficacy of wooden rails as compared with iron, also proving that carriages fitted with their guide wheels can travel on either iron or wood with equal effect, thus enabling main trunk lines of iron to construct their branches with wood where the traffic will not admit of the expense of iron rails.

The difference between the superstructure of iron and of wood, at the present price of iron is upwards of £2,500 per mile:—viz.

Mr. Brunell, in his evidence before a Committee of the House of Commons, lately stated that a siugle line of iron rails, could be laid down for £2000 per mile: consequently a double line would be........................	£4000
The cost of laying down a double line of wooden rails would be..	1687
Leaving a balance in favor of wood	£2313

This saving is in the superstructure alone, without calculating the advantages as before mentioned, of avoiding expensive property, deep cuttings, and embankments, which may be estimated at £1200 to £1500 more.

(COPY.)

We hereby certify, that a piece of beech wood prepared by Payne's process, was laid down at the entrance of our wharf on the 15th of August, 1843, in such a position that every cart or waggon that enters or leaves the wharf must necessarily pass over it, from that time to the present, an average of 120 tons of goods have been carted over it per day, exclusive of empty waggons and carts not weighed.

W. & J. DALTON,
Union Wharf, Millbank-street,
Westminster.

May 6th, 1845.

(COPY.)

I hereby certify, that the piece of beech laid at the entrance of Mr. Dalton's yard, referred to in their certificate, was laid by me on the 15th of August, 1843, and taken up May 6th, 1845, the wear on which averaged three-eighths of an inch. I beg to state it is laid in the angle of the curb, so that every wheel has a grinding as well as a rolling motion over it.

T. BURSTALL,
Civil Engineer.

May 8th, 1845.